

The Development of the Atomic Model (I) Questions – Solutions

1. How did Dalton's atomic theory help explain the laws of conservation of mass?

- Chemical reactions are rearrangement of atoms (atoms are neither created nor destroyed)

What are some of the shortcomings of Dalton's atomic model?

Note that the following list is not exhaustive:

- Atoms are divisible (electrons, protons, neutrons)
- The same elements can have different masses (isotopes)

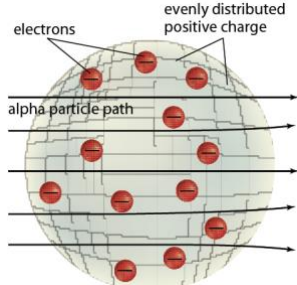
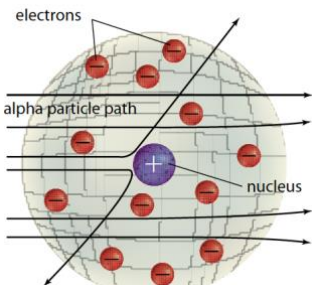
2. A friend of yours is confused about why Thomson's model of the atom was sometimes called the "plum pudding" model. How would you explain this to your friend?

- The raisins or plums in the pudding represent the electrons.
- The pudding itself (without the raisins or plums) represents the positive charge.

Is there a similar analogy you can use that might be more familiar to your friend?

- *Answers may vary:* chocolate chip cookies, where the chocolate chips represent the electron and everything else the positive charge.

3. Draw a diagram of what Rutherford and his students expected to happen when they directed alpha particles at the gold foil if the Thomson's model of the atom was correct. What did they observe when they performed their experiment (include a diagram)?

What they expected to see	What they observed
 <p>They expected to see most of the alpha particles traversing the gold foil without deviating from their path. They did expect some to be slightly deflected due to the presence of electrons.</p>	 <p>Some of the alpha particles deviated strongly from their path.</p>

* Images taken from McGraw-Hill Ryerson Chemistry 12 textbook.

4. How did Rutherford's gold foil experiment support that the atom was mostly empty space?

- A majority of the alpha particles traversed the gold foil without or slightly deviating.

Why did Rutherford conclude that the nucleus was positively charged?

- The alpha particles are positively charged and thus in order for them to deviate strongly from their path, it must be that it encountered a positively charged (sub)particle.

5. Describe the contributions of Dalton, Thomson, and Rutherford to the development of the atomic structure.

Name	Contribution
Dalton	<ul style="list-style-type: none"> • Atomic theory • Atom is a "solid ball"
Thomson	<ul style="list-style-type: none"> • Discovery of the electron (the atom is not indivisible) • "Plum pudding" model.
Rutherford	<ul style="list-style-type: none"> • Discovery of the proton. • "Planetary" model where electrons orbit around a positively charged nucleus.